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## PATENT ABSTRACTS OF JAPAN

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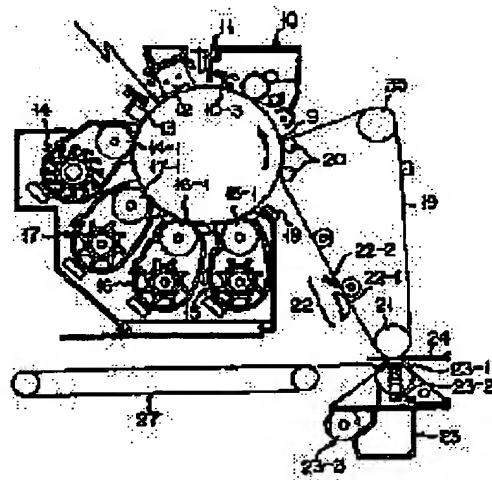
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SUZUKI TOMOMI**(54) IMAGE FORMING METHOD USING INTERMEDIATE TRANSFER SYSTEM****(57)Abstract:**

**PROBLEM TO BE SOLVED:** To prevent partial transfer failure (void) which occurs during transfer and image-reproducibility failure due to toner dust by keeping amounts of developer electrification high in order where developing toners in separate colors are developed onto an image carrier, and setting the absolute values of the amounts of developer electrification to specific ranges.

**SOLUTION:** Developing units 14-17 scoop up developers together with developing sleeves 14-1-17-1 rotating in such a manner that the developers face the photoreceptor 9 in order to develop an electrostatic latent image, and each of them is composed of a developing paddle rotating for stirring, a developer-toner concentration detection sensor, etc. In the image forming method using the intermediate transfer system, the amounts of developer electrification are made high in order of developing at least the black, cyan, magenta, yellow toners onto the image carrier 9, and the absolute values of the amounts of electrification are set to 10-30

$\mu\text{C/g}$ . Thus, a satisfactory transfer characteristic can be obtained, and development having void and transfer dust can be prevented.

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**CLAIMS**

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**[Claim(s)]**

[Claim 1] Repeat a production process which imprints a toner image on image support primarily on an endless-like middle imprint object two or more times, pile it up, and a transfer picture is formed. In an image formation method using a middle imprint method which bundles up a heavy transfer picture on this middle imprint object, and was secondarily imprinted on imprint material. An image formation method characterized by holding highly the amount of electrifications of a developer which uses at least a toner which consists of black, cyanogen, a Magenta, and a yellow color for order which carries out sequential development on image support, and making an absolute value of the amount of electrifications of a developer used into 10-30microc/g.

[Claim 2] An image formation method according to claim 1 which said toner used contains a hydrophobic silica at least, and is characterized by whenever [ condensation ] being 5 - 25%.

[Claim 3] An image formation method using a middle imprint method according to claim 1 characterized by for whenever [ said toner coloring / which is used / of each /-] being 2.2-2.8, and volume mean particle diameter of this toner being 4-9 micrometers.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]**

**[0001]**

**[The technical field to which invention belongs]** This invention makes middle imprint objects, such as a middle imprint belt, intervene, and relates in detail to the image-formation method and the image-formation equipment which perform image formation through each imprint production process of the primary imprint which imprints a toner image from image support to a middle imprint object, and the secondary imprint which imprints the primary transfer picture on a middle imprint object to imprint material about the image-formation method and the image-formation equipment which used electrophotography methods, such as a copying machine, a printer, and facsimile.

**[0002]**

**[Description of the Prior Art]** The image formation method of a middle imprint method and the equipment which pile up two or more visible color development images by which sequential formation is carried out on image support, for example, a photo conductor, one by one on the middle imprint object it runs in the shape of endless, for example, a middle imprint belt, imprint the first [ in all ] order, and imprint the primary transfer picture on this middle imprint object secondarily collectively to imprint material are known. The middle imprint method is especially adopted as a heavy imprint method of each color toner image in the so-called full color image formation equipment reproduced using the subtractive color mixture according the manuscript image whose color was separated to toners, such as Black, cyanogen, a Magenta, and yellow.

**[0003]** In such the image formation method and equipment, it originates in the local imprint omission at the time of the primary imprint of the toner which constitutes a color development image, and a secondary imprint, and a toner is not locally imprinted at all in the image on the imprint material by the transfer paper which is final image data medium, but the so-called worm-eaten portion may be produced. The example of such a worm-eaten image is shown in drawing 1 . in the case of an area image, a sign (w) shows a worm-eaten image at drawing 1 — as — a certain area — with — \*\*\*\* — it generates by becoming an imprint omission, and also, in the case of the Rhine image, generates by producing an imprint omission so that Rhine may break off. In order to lose this abnormality image, technology which is expressed below is proposed as technology for it that what is necessary is to be making it an imprint omission not occur, that is, just to raise imprint nature.

**[0004]** The existing technology for raising imprint nature can be classified into the following five.

(1) By using an elastomer for the technical a. middle imprint object about surface roughness reduction of a middle imprint object, and specifying the surface roughness of a middle imprint object What the adhesion of a middle imprint object and imprint material is raised, and aims at improvement and worm-eaten-like image generating prevention for imprint nature (JP,3-242667,A), And the surface roughness of b. middle imprint object is specified, and there are some (JP,63-194272,A, JP,4-303869,A, JP,4-303872,A, JP,5-193020,A) which aim at worm-eaten-like image generating prevention on an imprint disposition.

**[0005]** The conventional technology which belongs under the category of these (1) can say that it is accompanied by discharge development about the toner imprint which comes out between

the image support in a primary imprint production process, the middle imprint object between middle imprint objects and in a secondary imprint production process, and imprint material. Here, supposing a middle imprint body surface is the surface roughness of the shape of extreme irregularity, the imprint electric field over the toner on heights and a crevice will turn into heights imprint electric-field > crevice imprint electric field, and heights imprint electric field will become large relatively.

[0006] The reason can be explained as follows. Namely, when the electrode (I) which has the flat surface, and the electrode (II) which has the serrate surface which meets this electrode (I) through a minute air gap (Gp) are assumed with reference to drawing 2, The toner imprint electric field between image support, between middle imprint objects and a middle imprint object, and the transfer media between imprint material etc. As air gap electric field between these transfer media, they are primary imprint electric field... Air gap electric-field secondary imprint electric field between image support / middle imprint object ... The air gap electric field between a middle imprint object / imprint material can explain.

[0007] In drawing 2, when heights are set to (II-1), the crevice was set to (II-2) and imprint bias voltage is impressed to an electrode (I) and an electrode (II), as compared with the crevice (II-2) from which are separated of a distance inter-electrode [ these ], discharge concentrates on heights (II-1) with a short distance. That is, it becomes heights air gap electric-field > crevice air gap electric field. For the same reason, the air gap electric field of heights when the surface roughness of a middle imprint object is large, and a crevice turn into heights imprint electric-field > crevice imprint electric field.

[0008] Since it is such and is located in electric field with the larger toner in heights as compared with the toner in a crevice when it considers that the toner configuration of heights and crevice both is the same, it becomes that it is easy to imprint in response to the big electrostatic force. That is, as compared with heights, it can be said that a crevice is hard to imprint. Moreover, since the adhesion force to the middle imprint object of the toner located in DETCH of a crevice etc. is larger than the adhesion force to the middle imprint object of the toner located in the edge of heights etc., it can be said that a crevice is hard to imprint.

[0009] That is, a touch area becomes [ the direction of the \*\*\*\* crevice contact shown in drawing 3 (c) and drawing 3 (d) compared with the \*\*\*\* heights contact shown in the \*\*\*\* plane contact which showed the effective adhesion side of a toner to drawing 3 (a) supposing Men who performed / one grain of toner / hatching for the contact surface with the sign (T) in \*\*\*\* in drawing 3 showed, respectively, and drawing 3 (b), respectively ] large. When the mutual material which contacts is the same system, since van der waals force works to vicinal faces (= adhesion side), the size of an effective adhesion side serves as size of adhesion force, and homonymy. Therefore, it becomes crevice adhesion force > heights adhesion force.

[0010] It can be said that the roughness of a middle imprint body surface is good for granularity to make it little orientation from the above thing to the level from which the difference in the imprint nature by surface irregularity does not pose a parenchyma top problem. Although this is also being able to say a photo conductor, it is common knowledge for the surface roughness of a photo conductor to go back to the drum using Se photo conductor in ancient times, and to control the surface roughness to constant value in consideration of imprint nature about this photo conductor. Therefore, it is meaningful for generating prevention of a worm-eaten-like image to adjust the roughness of a middle imprint body surface to the level from which the difference in the imprint nature by irregularity does not pose a parenchyma top problem.

[0011] However, there is a limit in reduction-ization of the surface roughness of a middle imprint object, and surface irregularity is not only the irregularity of an always fixed configuration as shown in drawing 2. It is not that to which field strength only becomes settled with the distance between crevice-heights in the case of the irregularity from which a configuration differs, either. For example, the difference in the charge degree of concentration by the difference in the size of the width of face even if heights are the same height, For example, it changes also with differences in whether it is the thing of an obtuse angle which has the top area which does not have so much whether the tip of heights is the thing of the sharp acute angle which a charge tends to concentrate, and concentration of a charge, and a problem imprint object mutual

[ actual / each ] is not so simple.

[0012] (2) The linear velocity between the technical transfer media about a setup of the linear-velocity difference between transfer media is specified, and what aims at worm-eaten abnormality image generating prevention (JP,2-213882,A) is mentioned on an imprint disposition.

[0013] The primary imprint which is an imprint between a photo conductor and a middle imprint object is made into an example, and this conventional technology of (2) is explained. When the linear velocity of a photo conductor and a middle imprint object is equal, the electric force must be made to act so that a toner may be shifted to a middle imprint object side only in imprint electric field to the adhesion force which works between a photo conductor and a toner. (however, when establishing a linear-velocity difference between a photo conductor and a middle imprint object (i.e., when a fixed linear-velocity difference is among both), and when) The both sides of the mechanical force which originates in the speed difference of a photo conductor and a middle imprint object to a toner on the occasion of an imprint, and the electric force by imprint electric field can be made to act. Therefore, if the latter on which the both sides of the mechanical force and the force by imprint electric field can be made to act can say that it excels in imprint nature and it considers a worm-eaten-like image to be a phenomenon by microscopic imprint nature lack It can say that it is more advantageous to the dissolution of a worm-eaten abnormality image to establish a linear-velocity difference between transfer media (between a photo conductor and a middle imprint object). However, in establishing a linear-velocity difference between transfer media, shearing force is given to a toner image according to the linear-velocity difference, distortion of an image is produced, and it becomes a victory..

[0014] (3) The technical imprint nip pressure about reduction of imprint nip pressure is specified, and what aims at worm-eaten-like image generating prevention (JP,1-177063,A, JP,4-284479,A) is mentioned on an imprint disposition. The primary imprint which is an imprint between a photo conductor and a middle imprint object is made into an example, and such conventional technology of (3) is explained. It is pressed by that a photo conductor and a middle imprint object are mechanical or electrostatic force on the occasion of the primary imprint (imprint nip pressure). That is, the toner which intervenes among both will be pressed. With contiguity of the between [ toner particles ] distance by this press, the Juan Dell Wace force increases and the attraction between the toner particle components by condensation of a toner also increases. It can be told from a viewpoint of these reasons to imprint nature that it is desirable to make imprint nip pressure low to the dissolution of a worm-eaten-like image.

[0015] However, both transfer media are stuck more, and if things are advantageous because of maintenance of the exact imprint physical relationship of a toner and carry out mutual distance from this viewpoint small smoothly, there is a limit in reduction-ization of imprint nip pressure.

[0016] (4) The wettability of the technical a. middle imprint object material about reduction of the surface energy of a middle imprint object is specified to smallness, and what aims at worm-eaten-like image generating prevention (JP,2-198476,A, JP,2-212867,A) is mentioned on an imprint disposition. Here, wettability means the adhesion force between a liquid and a solid-state. Adhesion force is  $W = \gamma A (1 + \cos\theta)$ , when  $W$  shows the adhesion force which is the energy taken to pull apart material of a different kind, therefore sets the contact angle when placing a liquid for the surface tension of a liquid on  $\gamma A$  and a solid-state to  $\theta$ , and acts between these liquids and a solid-state... (1)

It can come out and express. It can ask for the surface tension (= critical surface tension) of the material which becomes  $X$  by the following methods. That is, the reagent with which surface tension ( $\gamma A$ ) differs is dropped on Material  $X$ , a contact angle ( $\cos\theta$ ) is measured, and the surface tension ( $\gamma A$ ) of a reagent and the relation of each contact angle ( $\cos\theta$ ) are plotted the appropriate back. It asks for the surface tension ( $\gamma_{ae}$ ) of the point that connect so-called each point of a JISUMAN plot, and that production crosses the line of  $\cos\theta = 1$  concerning this plot. This called-for surface tension is called critical surface tension (= surface tension).

[0017] Here, since it is I. reagent regularity supposing it measured the same reagent of arbitration and measures wettability ( $W$ ) of various materials with water, surface tension  $\gamma A$  in (1) type becomes fixed.

RO., therefore wettability (W) and a contact angle (costheta) become proportionality. It can be said from above-mentioned I and RO that measuring wettability (W) of various materials with the same reagent is searching for the contact angle (costheta) with the same surface tension ( $\gamma_A$ ). On the other hand, in many cases, a JISUMAN plot serves as a straight line, and the inclination does not change extremely with materials. As mentioned above, the wettability comparison of a material with the same reagent, for example, water, can say it also as the surface tension comparison of a material.

[0018] Although it is going to prevent generating of a worm-eaten image with technology said JP,2-198476,A and given in JP,2-212867,A using a wettability small middle imprint material, in other words, this can be called what has prevented generating of a worm-eaten image using the small middle imprint material of surface energy.

[0019] b. Further, a middle imprint object is considered as a multilayer configuration, the thing (JP,62-293270,A, JP,5-204255,A, JP,5-204257,A, JP,5-303293,A) which aims at worm-eaten-like image generating prevention on an imprint disposition, and the material which was excellent in the mold-release characteristic in c. middle imprint body surface are supplied by making the material excellent in the mold-release characteristic into the maximum surface, and what aims at worm-eaten-like image generating prevention (JP,58-187968,A) can be classified into the technology of the above (4) on an imprint disposition. With the technology of the above (4), the surface tension of a middle imprint object was stopped low, the mold-release characteristic over a toner was raised, and the imprint nature to imprint material is improved. It is a well-known fact that the adhesion force between dissimilar material is expressed as a function of surface tension, and the adhesion force of a toner to a middle imprint object increases with the increment in surface tension. Here, in the case of a pure substance, surface tension is synonymous with surface energy. Moreover, as well as wettability if it generally is not a pure substance, surface tension is treated as a substitution property of surface energy.

[0020] In the technology of the above (4), each adhesion force of a toner, image support and a toner, a middle imprint object and a toner, and imprint material is force synthesizing all physical force that acts, such as electrostatic force of each part material, and van der waals force. And although reduction-izing of the surface energy in a middle imprint object is convenient in a secondary imprint so that I may be understood from said explanation, in a primary imprint, it not necessarily always does not necessarily act advantageously.

[0021] (5) The technical middle imprint body surface about removal of the toner filming layer of a middle imprint body surface is refreshed by filming polishing etc., imprint nature is maintained, and the things (JP,5-273893,A, JP,5-307344,A, JP,5-313526,A, JP,5-323802,A, etc.) which aim at prevention of worm-eaten-like image generating by the passage of time are mentioned.

[0022] The above mentioned (1) Among the technology of - (4), temporarily, supposing the technical technical problem of (4) is attained and the surface tension of a middle imprint object is reduced as an ideal, it will stop occurring and filming of a middle imprint object will become unnecessary [ the technology of (5) ]. That is, it can be said that the technology of (5) is complement technology compensated with the technology of (4).

[0023] On the other hand, when performing roller transfer through a roller as a means of a secondary imprint, it is easy to generate the worm-eaten image in a secondary imprint production process. It is based on two reasons, the following a and b.

a. In the case of a full color image, in addition to toner thickness becoming thick, the mechanical adhesion force to a middle imprint object increases according to increase of the mechanical adhesion force which is the non-Coulomb force between the surface of a middle imprint object and a toner occurring powerfully, i.e., roller \*\* by the pressure welding of a roller, the effective density of a toner increases, and van der waals force increases by toner contiguity, consequently the adhesion force between toners to a middle imprint object increases with contact pressure with a roller.

[0024] b. In the process which carries out repeat activation of the image formation process, adhesion force generates the filming phenomenon of a toner in which a toner adheres to a middle imprint body surface in the shape of a film, between a lifting, a middle imprint body surface, and a toner. That is, although selection use of surface tension or the small material of surface energy



is generally carried out so that toner filming may not occur on a middle imprint object, (i "the adhesion force corresponding to the surface tension between a middle imprint object and a toner") will be generated also in such a case. And once toner filming occurs, although the adhesion force between "a middle imprint object and a toner" serves as (ii "the adhesion force determined with the surface tension of toners"), it is clear here. [ of the adhesion force of (ii) being larger than the adhesion force of (i) ] By the above, since the adhesion force between toners increases, while an imprint is not made partially, an omission phenomenon occurs, and it can be said that a worm-eaten image is produced.

[0025] It is United States Patent as a means to avoid this inside omission phenomenon, about generating of the worm-eaten image in a secondary imprint production process. There is technology indicated by the No. 5,053,827 specification (METHOD AND APPARATUS FOR INTERMITTENT CONDITIONING OF A TRANSFER BELT).

[0026] The roller (conditioning mean) which consists of members which consist of a material of the fluorine system which has surface energy smaller than the middle imprint hair side of belt side energy as a middle imprint object is applied to the middle imprint belt surface, and this United States Patent has the indication by having the conditioning process which reduces the surface energy of the middle imprint belt surface.

[0027] Furthermore, the middle imprint belt using a polycarbonate is made into an example. The early surface energy is 37 - 38 dyn-cm, and if a conditioning process is not used, it will go up to 40 - 45 dyn-cm. If 40 dyn-cm is exceeded, in order to suppose that the fault of an imprint will occur and to avoid this fault As described above, the roller formed with the material which used the fluorine of 30 or less dyn-cm as the base is applied to a belt, the thin coat layer of a fluorine material is formed in the surface, and it is said that a surface energy rise of the belt surface is controlled. Furthermore, when hair side of belt side energy is lowered too much, reverse has the indication of the purport which fault generates in the imprint to a middle imprint belt from a photo conductor at this United States Patent.

[0028] In the image formation equipment using the middle imprint belt (19) shown in drawing 1 mentioned later, when we used the middle imprint belt made from the polycarbonate, in the secondary imprint, the worm-eaten image generated them in the passage of time.

[0029] When the experiment which carried out optimum dose spreading of the zinc stearate was conducted on the middle imprint belt as lubricant, the fault of a secondary imprint was canceled, but when the coating weight of a toner decreased, the image of the letter of "a blur" was generated and the source location was checked, it became clear that it had happened at the primary imprint production process.

[0030] By the middle imprint belt using ETFE (ethylene-tetra-FURORO ethylene copolymer) which is the material of a fluorine system, the above-mentioned "blur" phenomenon occurred from the first stage. As opposed to middle imprint hair side of belt side energy being controlled by a certain level according to said conditioning process, if this is checked with the conventional example Although the photo conductor which is toner image support is grinding the surface with the cleaning-brush roller etc. A toner adheres to the surface in the shape of a film like a middle imprint belt with time, or Ozone, NOx, etc. are polluted by the discharge generation gas of a corona charger, surface energy goes up gradually, and a toner is considered to be because it to become easy to adhere to a photo conductor side mechanically and for imprint nature to be spoiled.

[0031] The black toner image imprinted as the image section reproduced in black toner monochrome, such as the black alphabetic character section, in the equipment which has the order of imaging which piles up an image to the middle imprint object other than the fault by which some toner images are not imprinted actualizes deterioration of this imprint engine performance also as fault imprinted by reverse to a photo conductor at subsequent production processes in order of Black, cyanogen, a Magenta, and yellow. Incidentally, it is thought that fault occurred from the first stage by the middle imprint belt of ETFE because the surface energy differences of the photo conductor surface and the middle imprint belt surface differed greatly in the initial state.

[0032] In order to avoid such faults, when middle imprint hair side of belt side energy becomes

high too much, with the technology concerning said United States Patent, it is carrying out to operating a conditioning process. A conditioning process is operated when the copy number of sheets decided beforehand is specifically exceeded.

[0033] However, it is clear un-arranging [ which interrupts a copy activity and operates a conditioning process ], and the middle imprint belt surface of be [ it / in a fixed condition / necessarily ] is clear after the copy number of sheets always decided beforehand.

[0034] Moreover, if it observes about the toner used, in order to prevent a worm-eaten image, the method of raising the fluidity of a toner and making migratory [ at the time of an imprint ] raising, and the method of adding a resin particle etc. to a toner and preventing the consolidation of the toners by the press at the time of an imprint are learned. However, when improving the fluidity of a toner too much, there is a case where become easy to generate the phenomenon in which a toner breaks up, and faithful reappearance of an alphabetic character etc. becomes impossible at the time of an imprint.

[0035]

[Problem(s) to be Solved by the Invention] Therefore, the purpose of this invention cancels the trouble in the above-mentioned conventional technology, and is in the image formation method using a middle imprint method to prevent the local poor imprint (worm-eaten) generated at the time of an imprint, and the poor repeatability of the image by Chile of a toner.

[0036]

[Means for Solving the Problem] The above-mentioned technical problem repeats a production process which imprints a toner image on (1) "image support of this invention primarily on an endless-like middle imprint object two or more times, piles it up, and forms a transfer picture. In an image formation method using a middle imprint method which bundles up a heavy transfer picture on this middle imprint object, and was secondarily imprinted on imprint material At least a toner which consists of Black, cyanogen, a Magenta, and a yellow color The amount of electrifications of a developer used for order which carries out sequential development on image support is held highly. And an image formation method characterized by making an absolute value of the amount of electrifications of a developer used into 10-30microc/g", "(2) Said toner used contains a hydrophobic silica at least. "An image formation method given [ aforementioned ] in (1) term characterized by whenever [ condensation ] being 5 - 25%", and (3) Whenever [ said toner coloring / which is used / of each /-] are 2.2-2.8. It is solved by and image formation method using a middle imprint method given [ aforementioned ] in (1) term characterized by volume mean particle diameter of this toner being 4-9 micrometers." "Moreover, (4) Repeat a production process which imprints a toner image on image support primarily on an endless-like middle imprint object two or more times, pile it up, and a transfer picture is formed. In image formation equipment using a middle imprint method which bundles up a heavy transfer picture on this middle imprint object, and was secondarily imprinted on imprint material At least a toner which consists of Black, cyanogen, a Magenta, and a yellow color The amount of electrifications of a developer used for order which carries out sequential development on image support is held highly. And image formation equipment characterized by making an absolute value of the amount of electrifications of a developer used into 10-30microc/g", "(5) Said toner used contains a hydrophobic silica at least. "Image formation equipment given [ aforementioned ] in (4) terms characterized by whenever [ condensation ] being 5 - 25%", and (6) Whenever [ said toner coloring / which is used / of each /-] are 2.2-2.8. It is solved by and the image formation equipment using a middle imprint method given [ aforementioned ] in (4) terms characterized by volume mean particle diameter of this toner being 4-9 micrometers."

[0037] Although it passes through a production process imprinted at once on imprint material (secondary imprint) after a toner of a color with which this inventions differ on a middle imprint object in a target image formation method laps, on a middle imprint object, the sequential imprint (primary imprint) of each color toner is carried out from image support. In this case, fault that the amount of electrifications becomes easy to rise, the imprint property of a toner at the time of a secondary imprint will change with order of a primary imprint in order to receive many charge hysteresis on a middle imprint object, and a color tone of a color picture will differ from an original manuscript produces a toner imprinted primarily first. Such fault is canceled by this

invention. Hereafter, this invention is explained to details.

[0038] It became clear that an imprint property at the time of a secondary imprint of two or more colors fixed-izes by color, and a color picture of a stable color tone is obtained by making the amount of electrifications of a developer to be used high in order of development as a result of this invention persons' examination. Moreover, an absolute value of the amount of electrifications of a developer is desirable, in order that considering as 10-30microc/g may be stabilized and it may acquire an imprint property.

[0039] Furthermore, in order to attain the purpose of this invention, it is necessary to give a suitable fluidity, and as for whenever [ condensation ], to a toner used for this invention, it is desirable that it is 5 - 25%. When whenever [ condensation ] is less than 5%, Chile of a toner at the time of an imprint may occur, and, in an adult case, worm-eaten may occur rather than 25% at the time of an imprint.

[0040] Measurement of whenever [ condensation / of a toner ] can be performed by following methods. That is, using a powder circuit tester (Hosokawa Micron CORP. make), a screen (75 micrometers of openings, 45 micrometers, and 22 micrometers) is arranged in this order from a top, a 2g toner is thrown into a screen of 75 micrometers of openings, vibration is given for 30 seconds with amplitude of 1mm, weight of 0.5, and 0.3 and 0.1 is applied and added to each measurement, and toner weight of each plus sieve after vibration is computed by percentage.

[0041] Moreover, it is effective in order that a hydrophobic silica may attain the purpose of this invention as an additive mixed especially to a toner. A here hydrophobic silica usually shows 50% or more of thing whenever [ hydrophobing ]. Whenever [ hydrophobing / of silica impalpable powder ] is controllable by carrying out surface treatment (hydrophobing processing) of the surface of silica impalpable powder with a silane system compound. That is, a silane compound is made to react to a hydroxyl group combined with silica impalpable powder, and it can control by replacing a hydroxyl group by a siloxyl radical etc. Therefore, whenever [ hydrophobing ] is the rate of a hydroxyl group which disappeared by the above-mentioned reaction among hydroxyl groups which existed before hydrophobing. Hydrophobing processing is performed by making a dialkyl dihalogen-ized silane, a trialkyl halogenation silane, hexa alkyl disilazane, an alkyl TORIHAROGEN-ized silane, etc. react to silica impalpable powder under an elevated temperature.

[0042] Moreover, whenever [ hydrophobing / of said silica impalpable powder ] can be measured by following method. That is, 50ml of water is put into a 200ml beaker, and 0.2 moreg silica impalpable powder is added. and ml of a dropping methanol when silica impalpable powder with which a tip is adding a methanol from a buret immersed underwater, and is appearing beginning to sink, and sinking completely at the time of dropping, agitating gently with a magnet stirrer, — reading and hydrophobing whenever = — { — ml of a dropping methanol — a number — / (ml of 50+ dropping methanol number) } x 100 (%)

since — it asks. Since silica impalpable powder which carried out a role of a surfactant in this case, and has floated with dropping of a methanol distributes a methanol underwater through a methanol, whenever [ hydrophobing / of silica impalpable powder ] is so high that a value of whenever [ hydrophobing ] is large. Moreover, 0.1-2.0 weight section addition of the content of a hydrophobic silica used for this invention is carried out to the toner particle 100 weight section. Moreover, it is a 0.3 - 1.5 weight section degree especially preferably.

[0043] Furthermore, it became clear to phenomena, such as worm-eaten [ at the time of the above-mentioned imprint ], and Chile of a toner, that a direction with little coating weight per unit area of a toner developed is advantageous as a result of this invention persons' examination.

[0044] That is, although a toner is further transferred to imprint material, when there is much coating weight of a toner, condensation of toners is promoted by consolidation of a toner by the press at the time of an imprint, and it is easy to generate Chile from image support, without [ a middle imprint object and ] becoming easy to generate worm-eaten and being able to perform transition of a still more faithful toner.

[0045] Moreover, although it is generally desirable for high-definition-izing to diameter[ of a granule ]-ize a toner, it becomes easy to generate the aforementioned worm-eaten phenomenon

by diameter[ of a granule ]-izing. Therefore, although it is desirable to lessen development coating weight of a toner further, in this case, image concentration runs short and a high-definition image is no longer obtained.

[0046] Therefore, it is necessary to raise whenever [ toner coloring-]. On the other hand, when there is too little coating weight of a toner, a feeling of ZARATSUKI of an image comes to be conspicuous. It is desirable to set whenever [ toner coloring-] to 2.2-2.8 from these points.

[0047] Whenever [ toner coloring-] was measured as follows here. That is, toner 1mg/cm<sup>2</sup> were made to adhere to a transfer paper (the Ricoh make, Types 6000 and 70W), an anchorage device of Ricoh PURITERU 550 was passed, and image concentration was measured for a fixing image with a 938 SUPEKUTORO densitometer made from X-Rite. Moreover, as for volume mean particle diameter of a toner used for this invention, it is desirable to be referred to as 4-9 micrometers. While a feeling of ZARATSUKI of an image is lost by being referred to as 9 micrometers or less, a high image of resolution is obtained. Moreover, in the case of less than 4 micrometers, worm-eaten [ at the time of an imprint ] may occur.

[0048] Hereafter, a toner and a developer which are used for this invention are explained to details. As binder resin used in a toner used by this invention, all things used as binding resin for toners from the former are applied. Specifically Styrene, such as polystyrene, Pori p-chloro styrene, and polyvinyl-toluene, and a polymer; styrene-p-chloro styrene copolymer of the substitution product, A styrene-propylene copolymer, a styrene-vinyltoluene copolymer, A styrene-vinyl naphthalene copolymer, a styrene-methyl-acrylate copolymer, A styrene-ethyl-acrylate copolymer, a styrene-butyl acrylate copolymer, A styrene-acrylic-acid octyl copolymer, a styrene-methyl-methacrylate copolymer, A styrene-ethyl methacrylate copolymer, a styrene-methacrylic-acid butyl copolymer, A styrene-alpha-Krol methyl-methacrylate copolymer, a styrene acrylonitrile copolymer, A styrene-vinyl methyl ether copolymer, a styrene-vinyl ethyl ether copolymer, A styrene-vinyl methyl ketone copolymer, a styrene-butadiene copolymer, A styrene-isoprene copolymer, a styrene-acrylonitrile-indene copolymer, Styrene system copolymers, such as a styrene-maleic-acid copolymer and a styrene-maleate copolymer; Polymethylmethacrylate, Poly butyl methacrylate, a polyvinyl chloride, polyvinyl acetate, polyethylene, Polypropylene, polyester, polyvinyl butyl butyral, polyacrylic resin, These are independent, or rosin, denaturation rosin, terpene resin, phenol resin, aliphatic series or alicycle group hydrocarbon resin, aromatic series system petroleum resin, chlorinated paraffin, paraffin wax, etc. are mentioned, and they are used by two or more sorts, mixing. In these, especially desirable things are polyol resin, polyester, and an epoxy resin in this invention.

[0049] In a toner of this invention, in order to give suitable electrification for a toner, it is desirable to make an electrification control agent contain. As an electrification control agent in this case, material of a white system is added from a transparent plane color which does not spoil a color tone of a color toner, and what can carry out stabilization grant of the toner electrification nature is desirable to negative polarity or straight polarity. As a thing of straight polarity, quarternary ammonium salt, an imidazole metal complex, salts, etc. are used, and, specifically, a salicylic-acid metal complex, salts, organic boron salts, a calyx allene system compound, etc. are used as a thing of negative polarity.

[0050] Moreover, a stain pigment as a coloring agent which can obtain a toner of yellow, a Magenta, cyanogen, and the Black color can be used. for example, independent in any conventionally well-known stain pigments, such as stain pigments, such as carbon black, lamp black, ultramarine blue, aniline bule, copper phthalocyanine blue, Phthalocyanine Green, Hansa yellow G, rhodamine 6G, a lake, KARUKO oil blue, chrome yellow, Quinacridone, benzidine yellow, a rose bengal, and a triaryl methane system color, -- or it can be used, mixing. The amount of these coloring agents used is usually 3 - 20 % of the weight preferably one to 30% of the weight to binding resin.

[0051] Moreover, it is possible to add titanium oxide, an alumina, etc. hydrophobic for the purpose which raises a fluidity other than a hydrophobic silica shown in this invention as an external additive added to a toner. In addition, fatty-acid metal salts (zinc stearate, aluminum stearate, etc.), polyvinylidene fluoride, etc. may be added if needed.

[0052] Moreover, it is possible to give electrification to a toner, to mix with a carrier in order to

convey a toner in a development unit, and to use it as a two component developer. That by which iron powder with a particle size of about 20-200 micrometers, nickel powder, ferrite powder, a glass bead, etc. coated the surface with mixture of these resin, such as a styrene-acrylic ester copolymer, a styrene-methacrylic ester copolymer, an acrylic ester polymer, a methacrylic ester polymer, silicone resin, polyamide resin, ionomer resin, and polyphenylene sulfide resin, by making these into a core material as a carrier again is used.

[0053]

[Embodiment of the Invention] Hereafter, this invention shoots based on drawing 4, and the example of the image formation method and the example of equipment are further explained to details. In the equipment of drawing 4, the color picture data from the color scanner which is not illustrated is changed into a lightwave signal, and an electrostatic latent image is formed in a photo conductor (9) of the write-in optical unit which performs the optical writing corresponding to a manuscript image and which is not illustrated. This optical unit is well-known in itself, and consists of a laser diode, a polygon mirror, a polygon motor, an image formation lens, a reflective mirror, etc. a photo conductor (9) — an arrow head — like — a counterclockwise rotation — rotating — although — The cleaning unit which contains a front [ cleaning ] electric discharge machine, a KUNININGU roller, and a cleaning blade (10-3) in the surroundings of it (10), electric discharge — a lamp — (— 11 —) — electrification — a vessel — (— 12 —) — potential — a sensor — (— 13 —) — Bk — a development counter — (— 14 —) — C — a development counter — (— 15 —) — M — a development counter — (— 16 —) — Y — a development counter — (— 17 —) — development — concentration — a pattern — a detector — (— 18 —) — middle — an imprint — a belt — (— 19 —) — etc. — arranging — having — \*\*\*\*. Each development counter (14) - (17) consists of a development paddle which rotates in order to pump up and agitate development - (17-1) and the sleeve (14-1) which are rotated so that a developer may be made to counter a photo conductor (9), in order to develop an electrostatic latent image, and a developer, a toner concentration detection sensor of a developer, etc. Here, the example which set sequence (color toner formation sequence) of development actuation to Bk, C, M, and Y explains actuation below (however, sequence is not restricted to this).

[0054] If copy actuation understands and is carried out, the read of Bk image data will start from timing predetermined with the color scanner which is not illustrated, and the optical writing by the laser beam and latent-image formation will start based on this image data (Bk latent image is called hereafter.). Suppose that it is the same also about C, M, and Y. That development should be made possible from the point of this Bk latent image, before a latent-image point arrives at the development location of Bk development counter (14), rotation initiation of the development sleeve (14-1) is carried out, and Bk latent image is developed with Bk toner (the amount of electrifications is held to min). Then, although development actuation of Bk latent-image field is continued, when Bk latent-image back end section passes through Bk development location, it changes into a development non-operative condition. This is made to complete at least before the following C image point reaches.

[0055] Subsequently, Bk toner image formed on the photo conductor (9) is imprinted on the surface of the middle imprint belt (19) by which the uniform drive is carried out with the photo conductor (9) (the toner image imprint to a middle imprint belt (19) from a photo conductor (9) is hereafter called "primary imprint"). A primary imprint is performed by impressing imprint bias voltage in the condition that the photo conductor (9) and the middle imprint belt (19) contacted. And sequential alignment of the toner image of Bk, C, M, and Y which carry out sequential formation to a middle imprint belt (19) at a photo conductor (9) is carried out in the same field, the primary transfer picture of 4 color piles is formed, and a package imprint (secondary imprint) is performed to a transfer paper after that. About the unit configuration of this middle imprint belt (19), and actuation, it mentions later.

[0056] Although it progresses after Bk production process in a photo conductor (9) side at C production process which used C toner which held the amount of electrifications small next, C image read by the color scanner begins from predetermined timing, and C latent-image formation is performed in the laser beam writing by the image data. After previous Bk latent-image back end section passed to the development location, and before the tip of C latent image reaches, C

development counter (15) carries out rotation initiation of the development sleeve (15-1), and develops C latent image with C toner which held the amount of electrifications small to the 2nd. Although the development of C latent-image field is continued after that, when the latent-image back end section passes, it changes into a development non-actuation condition like the case of previous Bk development counter. a mist [ this ] beam — it is made to complete before the following M latent-image point reaches About the production process of M and Y, since the amount of electrifications uses the toner held greatly one by one and also each image data read, latent-image formation, and actuation of development are the same as that of the production process of above-mentioned Bk and C, explanation is omitted.

[0057] The middle imprint belt (19) is constructed over the imprint bias roller (20), the driving roller (21), and the follower roller (35), and drive control is carried out from the drive motor 2 which is not illustrated. A belt cleaning unit (22) is constituted by the brush roller (22-1) which abbreviation one half has exposed, rubber blade (22-2) \*\*, etc., and carries out attachment-and-detachment actuation according to the attachment-and-detachment device which is not illustrated. The timing of this attachment-and-detachment actuation is made to desert a middle imprint belt (19) side until the primary imprint of Y (this example four amorous glance of the last color) is completed from a print start, is subsequent predetermined timing and cleans by making a middle imprint belt (19) side contact according to said attachment-and-detachment device.

[0058] The paper imprint unit (23) consists of attachment-and-detachment devices (23-3) from a paper imprint bias roller (23-1) (electric-field means forming for a secondary imprint), a roller cleaning blade (23-2), and a middle imprint belt (19) etc. Although this bias roller (23-1) has usually deserted the middle imprint belt (19), when carrying out the package imprint of the heavy image of four colors formed in the middle imprint belt (19) side at a transfer paper (imprint material) (24), it takes timing, is pressed by the attachment-and-detachment device (23-3), it impresses predetermined bias voltage to said roller (23-1), and performs the imprint to a transfer paper (24). Thus, the transfer paper (24) with which the package imprint of the 4 color pile images was carried out from the middle imprint belt (19) side It is conveyed in a paper conveyance unit (27) by the fixing assembly which is not illustrated, and the full color copy by which welding fixing was carried out in the toner image with the fixing roller controlled by predetermined temperature and the pressurization roller is obtained. On the other hand, the surface of the photo conductor after a belt imprint (9) is cleaned in a cleaning unit (10), and is further discharged by homogeneity with an electric discharge lamp (11). Moreover, as mentioned above, to the predetermined timing after belt imprint termination of Y image of the last color, according to said attachment-and-detachment device, cleaning of a middle imprint belt (19) presses a cleaning unit (22) to a middle imprint belt (19) side, and performs it.

[0059]

[Example] Hereafter, an example explains this invention to details further.

Example 1 <a black toner> Binding resin (polyol resin: 105 degrees C of softening temperatures) The 100 weight sections Electrification control agent (fluorine-containing quarternary-ammonium-salt compound) The 0.8 weight sections Coloring agent (carbon black) After mixing enough with a blender, melting kneading of the 7 weight sections was carried out with 2 rolls which heated at 100-110 degrees C. Coarse grinding of the kneading object was carried out by the cutter mill after natural radiationnal cooling, the pulverizer using a jet stream removed fines after grinding using pneumatic elutriation equipment, and the parent coloring particle was obtained. Furthermore, to this parent coloring particle 100 weight section, 60% of hydrophobic titanium oxide 0.8 weight section was mixed with the Henschel mixer whenever [ hydrophobing ], and the toner was obtained. Moreover, this toner was mixed with the turbular mixer at a rate of 5 weight sections to the carrier 100 weight section which carried out the surface coat of the silicone resin to the ferrite particle with a mean particle diameter of 50 micrometers, and it considered as the developer. In addition, as for the volume mean particle diameter of the obtained toner, whenever [ 2.0 and condensation ] was 26 whenever [ 9.2 micrometer and coloring ], and the amount of electrifications of a developer was -16microc/g. Moreover, about cyanogen, the Magenta, and the yellow toner, the toner was created on the same conditions as a black toner in the following configuration conditions, and the developer was acted similarly.

[0060]

[A table 1]

	シアントナー	マゼンタトナー	イエロートナー
結着樹脂	ポリオール樹脂：軟化点105℃ 100重量部		
帯電制御剤	含フッ素四級アンモニウム塩化合物 (0.9重量部) (1.0重量部) (1.2重量部)		
着色剤	銅フタロシアニン ブルー顔料 (C.I.Pigment Blue 15) (2.0重量部)	キナクリドン系顔料 (C.I.Pigment Red 122) (4.0重量部)	ジスアゾ系顔料 (C.I.Pigment Yellow 17) (4.5重量部)
外添加剤	疎水性酸化チタン（疎水化度60%） (0.8重量部) (0.8重量部) (0.8重量部)		

The property of the obtained toner and a developer is shown in a table 7. Moreover, the good result was obtained, when set to Ricoh PURITERU 550 the toner and developer which were obtained, negatives were developed in order of Black, cyanogen, a Magenta, and yellow, imprint nature (toner dust and worm-eaten) in the alphabetic character section at the time of 4 color piles was evaluated and evaluation of the ZARATSUKI nature of the solid section and image concentration was performed further. In addition, the method of evaluation was enforced as follows.

[0061] Worm-eaten rank rank 5 at the time of an imprint It is completely the non-generated rank 4. Rank 3 which worm-eaten [ 1-2 ] can check with a magnifier although it cannot check visually Rank 2 which worm-eaten [ several ] can check with a magnifier although it can hardly check visually Rank 1 which can check worm-eaten visually That most alphabetic characters have fallen out is [0062] which can be checked visually. Rank rank 5 of imprint Chile at the time of an imprint It is completely the non-generated rank 4. Rank 3 which can check slight Chile with a magnifier although it cannot check visually Rank 2 which several Chile can check with a magnifier although it can hardly check visually Rank 1 which Chile can check visually BOYAKE of the alphabetic character by Chile can check visually (magnifier: one 10 times the scale factor of this).

[0063] A ZARATSUKI nature rank rank 5 Uniform solid image rank 4 Rank 3 which the nonuniformity of an image can check slightly with a magnifier visually although it is uniform Rank 2 which can be checked with a magnifier although ZARATSUKI can hardly be checked visually Rank 1 which can check ZARATSUKI of an image visually Monochromatic concentration is measured with the level image concentration Macbeth reflection-density meter (made in Macbeth) which ZARATSUKI of an image is severe and cannot say as a solid image.

[0064] Example 2 [0065]

[A table 2]



	ブラックトナー	シアントナー	マゼンタトナー	イエロートナー
結着樹脂	ポリエステル樹脂：軟化点 110℃ 100重量部			
帯電制御剤	サリチル酸誘導体亜鉛塩			
	(1.0重量部)	(1.0重量部)	(1.0重量部)	(1.0重量部)
着色剤	カーボンブラック	銅フタロシアニンブルー (C.I.Pigment Blue 15)	キナクリドン系顔料 (C.I.Pigment Red 122)	アゾ系顔料 (C.I.Pigment Yellow 180)
	(7.2重量部)	(2.0重量部)	(3.8重量部)	(4.5重量部)
外添加剤	疎水性シリカ（疎水化度 70%）			
	(0.7重量部)	(0.7重量部)	(0.7重量部)	(0.7重量部)

The toner was created on the same conditions as an example 1, specified quantity mixing was carried out with the same carrier, and it considered as the developer. The same evaluation as an example 1 was performed using the toner and developer which were obtained. In addition, the obtained toner and the property of a developer, and also the evaluation result of image quality quality are indicated to a table 7.

[0066] Example 3 [0067]

[A table 3]

	ブラックトナー	シアントナー	マゼンタトナー	イエロートナー
結着樹脂	ポリオール樹脂：軟化点 110℃ 100重量部			
帯電制御剤	含フッ素四級アンモニウム塩化合物		サリチル酸誘導体亜鉛塩	
	(1.0重量部)	(1.0重量部)	(1.0重量部)	(1.2重量部)
着色剤	カーボンブラック	銅フタロシアニンブルー (C.I.Pigment Blue 15)	キナクリドン系顔料 (C.I.Pigment Red 122)	アゾ系顔料 (C.I.Pigment Yellow 180)
	(9.0重量部)	(3.5重量部)	(6.0重量部)	(6.0重量部)
外添加剤	疎水性シリカ（疎水化度 80%）			
	(0.5重量部)	(0.6重量部)	(0.7重量部)	(0.7重量部)

The toner was created on the same conditions as an example 1, specified quantity mixing was carried out with the same carrier, and it considered as the developer. The same evaluation as an example 1 was performed using the toner and developer which were obtained. In addition, the obtained toner and the property of a developer, and also the evaluation result of image quality quality are indicated to a table 7.

[0068] Example 4 [0069]

[A table 4]



	ブラックトナー	シアントトナー	マゼンタトナー	イエロートナー
結着樹脂	ポリエステル樹脂：軟化点 98℃ 100重量部			
帯電制御剤	含フッ素四級アンモニウム塩／サリチル酸誘導体亜鉛塩			
	(1.0/0.5重量部)	(0.8/0.7重量部)	(0.6/0.8重量部)	(0.4/0.9重量部)
着色剤	カーボンブラック	銅フタロシアニン ブルー (C.I.Pigment Blue 15)	キナクリドン系顔料 (C.I.Pigment Red 122)	アゾ系顔料 (C.I.Pigment Yellow 180)
	(9.0重量部)	(3.5重量部)	(6.0重量部)	(5.8重量部)
外添加剤	疎水性シリカ（疎水化度80%）			
	(0.6重量部)	(0.6重量部)	(0.7重量部)	(0.7重量部)

The toner was created on the same conditions as an example 1, specified quantity mixing was carried out with the same carrier, and it considered as the developer. The same evaluation as an example 1 was performed using the toner and developer which were obtained. In addition, the obtained toner and the property of a developer, and also the evaluation result of image quality quality are indicated to a table 7.

[0070] The example 1 of a comparison [0071]

[A table 5]

	ブラックトナー	シアントトナー	マゼンタトナー	イエロートナー
結着樹脂	ポリオール樹脂：軟化点 105℃ 100重量部			
帯電制御剤	含フッ素四級アンモニウム塩化合物			
	(1.2重量部)	(0.8重量部)	(0.8重量部)	(0.8重量部)
着色剤	カーボンブラック	銅フタロシアニン ブルー (C.I.Pigment Blue 15)	キナクリドン系顔料 (C.I.Pigment Red 122)	アゾ系顔料 (C.I.Pigment Yellow 180)
	(9.0重量部)	(3.5重量部)	(6.0重量部)	(6.2重量部)
外添加剤	疎水性酸化チタン（疎水化度20%）			
	(0.7重量部)	(0.7重量部)	(0.7重量部)	(0.7重量部)

The toner was created on the same conditions as an example 1, specified quantity mixing was carried out with the same carrier, and it considered as the developer. The same evaluation as an example 1 was performed using the toner and developer which were obtained. In addition, the obtained toner and the property of a developer, and also the evaluation result of image quality quality are indicated to a table 7.

[0072] The example 2 of a comparison [0073]

[A table 6]

	ブラックトナー	シアントナー	マゼンタトナー	イエロートナー
結着樹脂	ポリエステル樹脂：軟化点105℃ 100重量部			
帯電制御剤	含フッ素四級アンモニウム塩化合物			
	(1.0重量部)	(1.0重量部)	(1.0重量部)	(1.0重量部)
着色剤	カーボンブラック	銅フタロシアニン ブルー (C.I.Pigment Blue 15)	キナクリドン系顔料 (C.I.Pigment Red 122)	アゾ系顔料 (C.I.Pigment Yellow 180)
	(1.2重量部)	(5.0重量部)	(9.0重量部)	(9.0重量部)
外添加剤	疎水性シリカ（疎水化度30%）			
	(0.8重量部)	(0.8重量部)	(0.8重量部)	(0.8重量部)

The toner was created on the same conditions as an example 1, specified quantity mixing was carried out with the same carrier, and it considered as the developer. The same evaluation as an example 1 was performed using the toner and developer which were obtained. In addition, the obtained toner and the property of a developer, and also the evaluation result of image quality quality are indicated to a table 7.

[0074]

[A table 7]

実施例	トナー色 再現度↓	結着剤 樹脂	帯電剤 種類	カラートナーの構成・特性				現像剤 付着度 (wt%)	現像剤 付着量 ( $\mu\text{g}/\text{cm}^2$ )	画像品質評価結果			
				添加量 (重量部)	外添加剤	添加量 (重量部)	体積平均 粒径 ( $\mu\text{m}$ )			鮮色性 (色濃さ)	鮮色性 (色濃さ)	鮮色性 (色濃さ)	鮮色性 (色濃さ)
実施例 1	ブラック	ポリメ アクリル 樹脂	含フッ素 アクリル 樹脂	0.8	疎水性	0.8	9.2	2.0	26	4	4	5	1.7
	シアン			0.8	疎水性	0.8	8.9	2.0	27				1.8
	マゼンタ			0.8	疎水性	0.8	9.2	2.1	28				1.8
	イエロー			0.8	疎水性	0.8	9.2	1.9	27				2.0
実施例 2	ブラック	ポリメ アクリル 樹脂	含フッ素 アクリル 樹脂	0.7	疎水性	0.7	9.3	2.1	18	4.5	4.5	4.5	1.8
	シアン			0.7	疎水性	0.7	9.2	1.9	16				1.9
	マゼンタ			0.7	疎水性	0.7	9.4	1.8	15				1.8
	イエロー			0.7	疎水性	0.7	9.5	1.9	14				2.0
実施例 3	ブラック	ポリメ アクリル 樹脂	含フッ素 アクリル 樹脂	0.6	疎水性	0.6	8.1	2.4	23	5	5	5	2.2
	シアン			0.6	疎水性	0.6	8.0	2.3	20				2.2
	マゼンタ			0.7	疎水性	0.7	8.3	2.4	18				2.3
	イエロー			0.7	疎水性	0.7	7.9	2.5	18				2.2
実施例 4	ブラック	ポリメ アクリル 樹脂	含フッ素 アクリル 樹脂	1.0/0.5	疎水性	1.0/0.5	6.8	2.4	20	5	5	5	2.2
	シアン			0.8/0.7	疎水性	0.8/0.7	6.5	2.2	20				2.2
	マゼンタ			0.6/0.8	疎水性	0.6/0.8	6.2	2.3	18				2.2
	イエロー			0.4/0.9	疎水性	0.4/0.9	5.4	2.3	19				2.2
比較例 1	ブラック	ポリメ アクリル 樹脂	含フッ素 アクリル 樹脂	1.2	疎水性	1.2	6.2	2.3	33	2	2	2	2.2
	シアン			0.8	疎水性	0.8	6.6	2.3	34				2.3
	マゼンタ			0.8	疎水性	0.7	6.8	2.3	33				2.2
	イエロー			0.8	疎水性	0.7	6.4	2.3	35				2.3
比較例 2	ブラック	ポリメ アクリル 樹脂	含フッ素 アクリル 樹脂	0.8	疎水性	0.8	9.2	3.0	16	4	4	2	2.5
	シアン			1.0	疎水性	1.0	9.1	3.1	15				2.4
	マゼンタ			1.0	疎水性	0.8	9.4	3.0	16				2.4
	イエロー			1.0	疎水性	0.8	9.6	3.1	15				2.5

[0075]

[Effect of the Invention] As explained in detail and concretely, as mentioned above, this invention In the image formation method using a middle imprint method at least Black, The amount of electrifications of a developer makes it high at the order which develops the toner which consists of cyanogen, a Magenta, and a yellow color on image support. And it is a good imprint property's being acquired, being able to prevent worm-eaten and development called imprint Chile by making the absolute value of the amount of electrifications into 10-30microc/g, and a toner's containing a hydrophobic silica at least further, and making whenever [ condensation ] into 5 - 25%. Furthermore, the extremely excellent effect that a good imprint property is acquired and also a still better imprint property is acquired by setting whenever

[ toner coloring-] to 2.2–2.8, and setting volume mean particle diameter to 4–9 micrometers is demonstrated.

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[Translation done.]

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- 3.In the drawings, any words are not translated.

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DESCRIPTION OF DRAWINGS

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## [Brief Description of the Drawings]

[Drawing 1] It is drawing showing the worm-eaten example of an image generated in the conventional image formation method.

[Drawing 2] It is drawing explaining high surface roughness and worm-eaten image generating in the conventional image formation method.

[Drawing 3] It is drawing explaining worm-eaten image \*\*\*\*\* in the conventional image formation method.

[Drawing 4] It is drawing explaining the example of image formation equipment and the example of a method of this invention.

## [Description of Notations]

w Worm-eaten

I Electrode

II Electrode

II-1 Electrode heights

II-2 Electrode crevice

Gp Air gap

T Toner

9 Photo Conductor (Image Support)

10 Photo Conductor Cleaning Unit

10-1 Front [ Cleaning ] \*\*\*\*\*

10-2 Brush Roller

10-3 Rubber Blade

11 Electric Discharge Lamp

12 Electrification Machine

13 Potential Sensor

14 Bk Development Counter

14-1 Development Sleeve

15 C Development Counter

15-1 Development Sleeve

16 M Development Counter

16-1 Development Sleeve

17 Y Development Counter

17-1 Development Sleeve

18 Development Concentration Pattern Detector

19 Middle Imprint Belt

20 Imprint Bias Roller

21 Driving Roller

22 Belt Cleaning Unit

22-1 Brush Roller

22-2 Rubber Blade

23 Paper Imprint Unit

23-1 Paper Imprint Bias Roller  
23-2 Roller Cleaning Blade  
23-3 Attachment-and-Detachment Device  
24 Transfer Paper  
27 Conveyance Belt  
35 Follower Roller

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[Translation done.]

## \* NOTICES \*

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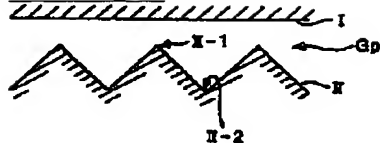
3.In the drawings, any words are not translated.

## DRAWINGS

[Drawing 1]



[Drawing 2]



[Drawing 3]

(a)

(b)

(c)

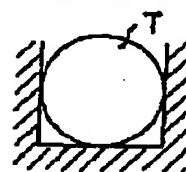
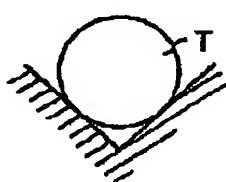
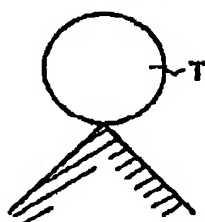
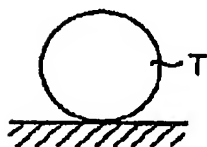
(d)

平面接触

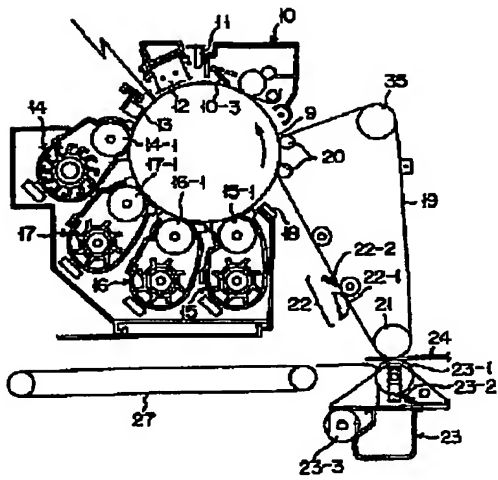
凸部接触

凹部接触 I

凹部接触 II



[Drawing 4]



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[Translation done.]



されればよく、そのための技術として、以下に述べるような技術が提案されている。  
【0004】転写性を向上させるための既存の技術は、次の5つに分類できる。

- (1) 中間転写体の表面粗度低減に関する技術
- a. 中間転写体にエラストマーを使用し、かつ、中間転写体の表面粗度を規定することで、中間転写体と転写材との密着性を向上させて、転写性を向上し、虫食い状画像の発生防止をはかるもの(特開平3-242667号公報)、および、b. 中間転写体の表面粗度を規定し、転写性向上、虫食い状画像発生防止をはかるもの(特開昭63-194272号公報、特開平4-303869号公報、特開平4-303872号公報、特開平5-193020号公報)がある。

【0005】これら(1)の範疇に属する従来技術は、一次転写工程における像担持体と中間転写体間、二次転写工程における中間転写体と転写材間、でのトナー転写に関するもので、放電現象をともなうといえる。ここで、中間転写体表面が極端な凹凸状の表面粗度であるとすると、凸部上と凹部上でのトナーに対する転写電界は、

凸部転写電界>凹部転写電界  
となり、凸部転写電界が相対的に大きくなる。  
【0006】その理由は、次のように説明できる。すなわち、図2を参照するに、平坦な表面を有する電極(1)と、この電極(1)に微小なエアギャップ(G)を有する電極(2)の表面を有する電極(11)を想定したとき、像担持体と中間転写体間、中間転写体と転写材間などの転写媒体間のトナー転写電界は、これら転写媒体間のエアギャップ電界として、  
一次転写電界...・像担持体/中間転写体間のエアギャップ電界  
二次転写電界...・中間転写体/転写材間のエアギャップ電界  
で説明できる。

【0007】図2において、凸部を(II-1)、凹部を(II-2)とすると、電極(11)に転写ベアス電圧が印加された場合、これら電極間の距離が離れている凹部(II-2)に比較し、距離が短い凸部(II-1)に放電が集中する。つまり、  
凸部エアギャップ電界>凹部エアギャップ電界  
となる。同様の理由により、中間転写体の表面粗度が大きい場合の凸部、凹部のエアギャップ電界は、  
凸部転写電界>凹部転写電界  
となる。

【0008】このようなことから、凸部、凹部両者のトナー形状を同一とみなした場合、凹部におけるトナーに比較して凸部におけるトナーの方が大きい電界中に位置するので、大きな静電的力を受けて転写されやすくなる。つまり、凸部に比較して、凹部は転写されにくいと

【特許請求の範囲】

【請求項1】 像担持体上のトナー像を無端状の中間転写体に一次転写する工程を複数回繰り返して重ね転写画像を形成し、この中間転写体上の重ね転写画像を一括して転写材上に二次転写するようにした中間転写方式を用いた画像形成方法において、少なくとも、ブラック、シアン、マゼンタ、イエロー色からなるトナーを、像担持体上に順次現像する際に、用いる現像剤の帯電量を高く保持し、かつ用いられる現像剤の帯電量の絶対値を1.0〜3.0μc/gとすることを特徴とする画像形成方法。

【請求項2】 前記用いられるトナーが、少なくとも緑水性シリカを含有し、帯電度が5〜25%であることを特徴とする請求項1記載の画像形成方法。

【請求項3】 前記用いられる各々のトナーの着色度が2.2〜2.8であり、かつ該トナーの体積平均粒径が4〜9μmであることを特徴とする請求項1記載の中間転写方式を用いた画像形成方法。

【発明の詳細な説明】

【0001】  
【発明の属する技術分野】 本発明は、複写機、プリンタ等、フロッピーディスクなどの電子写真方式を用いた画像形成方法及び画像形成装置に関する。詳しくは、中間転写ベルト等の中間転写体を介在させて、像担持体から中間転写体へトナー像を転写する一次転写、中間転写体上の一次転写画像を転写材へ転写する二次転写の各転写工程を連続して画像形成を行う画像形成方法及び画像形成装置に関する。

【0002】  
【従来の技術】 像担持体、例えば感光体上に順次形成される複数の可視の色現像画像を無端状に走行する中間転写体、例えば中間転写ベルト上に順次重ね合わせて一次転写し、この中間転写体上の一次転写画像を転写材に一括して二次転写する中間転写方式の画像形成方法及び装置が知られている。とりわけ、中間転写方式は、色分解された原稿画像をブラック、シアン、マゼンタ、イエローなどのトナーによる減色混合を用いて再現するいわゆるフルカラー画像形成装置において各色トナー像を重ね転写方式として採用されている。

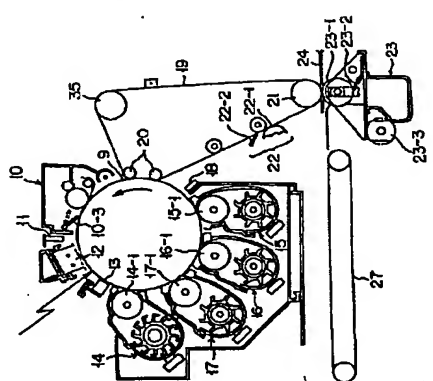
【0003】このような画像形成方法及び装置において、色現像画像を構成するトナーの一次転写時及び二次転写時における局所的な転写抜けに起因して、最終的な画像媒体である転写紙等による転写材上の画像中に、局所的に全くトナーが転写されず、所謂虫食い状の部分を生ずることがある。このような虫食い状の画像の例を図1に示す。虫食い状の画像は、面積画像の場合には図1に符号(w)で示すように、ある面積を以って転写抜けとなることにより発生する他、ライン画像の場合には、ラインが途切れるように転写抜けを生ずることにより発生する。かかる異常画像をなくするには、転写抜けが発生しないようにすることであり、つまり、転写性を向上

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(43)公開日 平成10年(1998)8月7日

(51)IntCl. <sup>4</sup> G 03 G 15/01	識別記号 114	FI G 03 G 15/01	J 114A 361 375
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	(74)代理人 弁護士 武井 秀彦		最終頁に続く

(54)【発明の名称】 中間転写方式を用いた画像形成方法

(57)【要約】  
【課題】 中間転写方式を用いた画像形成方法において、転写時に発生する局所的な転写不良(虫食い)や、トナーのチリによる画像の再現性不良を防止すること。  
【解決手段】 像担持体上のトナー像を無端状の中間転写体に一次転写する工程を複数回繰り返して重ね転写画像を形成し、この中間転写体上の重ね転写画像を一括して転写材上に二次転写するようにした中間転写方式を用いた画像形成方法において、少なくとも、ブラック、シアン、マゼンタ、イエロー色からなるトナーを、像担持体上に順次現像する際に、用いる現像剤の帯電量を高く保持し、かつ用いられる現像剤の帯電量の絶対値を1.0〜3.0μc/gとすることを特徴とする画像形成方法。



いえる。また、凹部のデッチなど位置するトナーの中間転写体に対する付着力は、凸部のエッジなどに位置するトナーの中間転写体に対する付着力よりも大きいので、凹部は転写されにくいといえる。

【0009】つまり、図3において概観的に、1粒のトナーを符号(7)で、接触面をハッチングを施した面であって、それぞれ示したトナーの実効付着量は、図3(a)に示した如き平面接触、及び図3(b)に示した如き凸部接触に比べて、図3(c)、図3(d)にそれぞれ示した如き凹部接触の方が接触面積が大きくなる。

接触する互いの材料が同一系の場合、近接面(=付着面)に対してファン・デル・ワールス力が働くことから、実効付着面の大小は付着力の大小と同義となる。したがって、  
凹部付着力>凸部付着力  
となる。

【0010】以上のことから、表面の凹凸による転写性の差異が実質上問題とならないレベルまで、中間転写体の表面の粗度は粗さが少ない傾向にするのがよいといえる。このことは、感光体にもいえることであるが、感光体の表面粗度は、古くはS<sub>8</sub>感光体を用いたドラムまで通り、かかる感光体についてその表面粗度を転写性を考慮して一定値に規制すること、周知である。したがって、凹凸による転写性の差異が実質上問題とならないレベルまで、中間転写体の表面の粗度を調整することは、虫喰い状画像の発生防止にとって、意味がある。

【0011】しかしながら、中間転写体の表面粗度の低減化には限界があり、また、表面の凹凸は図2に示すような常に一定の形状の凹凸ばかりではない。形状の異なる凹凸の場合には、電界強度は突出部-凸部間の距離により定まるものでもなく、例えば凸部が同じ高さであってもその幅の大小の違いにより電界集中度の違い、あるいは凸部の先端が電荷の集中し易い尖った形状のものであるか或いは電荷の集中がさほどない頂部面積を有する形状のものであるかの違いによっても異なり、現実の各転写体相互間における問題はさほど単純ではない。

【0012】(2) 転写媒体間での線速度差の設定に関する技術

転写媒体間の線速度を規定し、転写性向上、虫喰い状の異常画像発生防止をはかるもの(特開平2-213882号公報)が挙げられる。

【0013】この(2)の従来技術について、感光体と中間転写体との間の転写である一次転写を例にして説明する。感光体と中間転写体の線速度が等しい場合には、感光体とトナーとの間に働く付着力に対し転写電場のみでトナーを中間転写体側に移行するように電氣的な付着作用させなければならない。しかるに、感光体と中間転写体との間に線速度差を設ける場合、つまり、両者間に一定の線速度差がある場合は、転写に際してトナーに対して、感光体・中間転写体の速度差に起因する機械的な力

と転写電界による電氣的な力の双方を作用させることができ、したがって、機械的な力と転写電界による力の双方を作用させることで、後者の方が転写性に優れていると云うことができ、虫喰い状画像を微視的な転写性大如による現象と考えると、転写媒体間(感光体と中間転写体間)に線速度差を設けた方が虫喰い状の異常画像の解消に有利であるといえる。しかしながら、転写媒体間に線速度差を設ける場合にはその線速度差によりトナー像に剪断力を与え像の歪みを生じ勝たなくなる。

【0014】(3) 転写ニップ圧の低減に関する技術  
転写ニップ圧を特定化し、転写性向上、虫喰い状画像発生防止をはかるもの(特開平1-177063号公報、特開平4-284479号公報)が挙げられる。これらの(3)の従来技術について、感光体と中間転写体との間の転写である一次転写を例にして説明する。一次転写に際して感光体、中間転写体は機械的又は静電力により押圧されている(転写ニップ圧)。つまり、両者の間に介在するトナーは、押圧されていることとなる。この押圧によるトナー粒子相互間距離の近接に伴い、ファン・デル・ワールス力が増大し、また、トナーの電媒によるトナー粒子構成材料間の引力も増大する。これらの理由から、転写性の観点から、虫喰い状画像の解消には、転写ニップ圧を低くする方が望ましいといえる。

【0015】しかしながら、転写媒体相互をより密着させて相互間距離を小さくすることはトナーの正確な転写位置関係の保持のために有利であり、この観点からすれば転写ニップ圧の低減化には限界がある。

【0016】(4) 中間転写体の表面エネルギーの低減に関する技術

a. 中間転写体材料の濡れ性を小に特定化し、転写性向上、虫喰い状画像発生防止をはかるもの(特開平2-198476号公報、特開平2-212867号公報)が挙げられる。ここで、濡れ性とは、液体と固体との間の付着力を意味する。付着力とは、異種の物質を引き離すに要するエネルギーであり、したがって、液体の表面張力を $\gamma_A$ 、固体の上に液体を置くときの接触角を $\theta$ とし、これら液体と固体間に作用する付着力をWで示すと、

$$W = \gamma_A (1 + \cos \theta) \dots (1)$$

で表わすことができる。Xなる材料の表面張力(=境界表面張力)は以下の方法で求めることができる。即ち、接触角( $\cos \theta$ )の異なる試薬を材料X上に滴下し、接触角( $\gamma_A$ )とそれぞれの接触角( $\cos \theta$ )の関係を作図する。この作図にかかると、いわゆるジスマンプロットの

各点をつなぐその延長線が $\cos \theta = 1$ の線と交わる点の表面張力( $\gamma_0$ )を求める。この求められた表面張力を境界表面張力(=表面張力)と称する。

【0017】ここで、任意の同一試薬、例えば水で、各種材料の濡れ性(W)を測定したとすると、

イ. 試薬一定であるから、(1)式における表面張力 $\gamma_A$ は一定となる。  
ロ. したがって、濡れ性(W)と接触角( $\cos \theta$ )は比例関係になる。

上記イ、ロより、同一試薬で各種材料の濡れ性(W)を測定することは同一表面張力( $\gamma_A$ )で接触角( $\cos \theta$ )を求めることといえる。一方、ジスマンプロットは多くの場合、直線となり、その勾配は材料により極端に異なることはない。以上より、同一試薬、例えば水による材料の濡れ性比較は、材料の表面張力比較ともいえる。

【0018】前記特開平2-198476号公報、特開平2-212867号公報記載の技術では、濡れ性の小さい中間転写体材料を用いて虫喰い状の画像の発生を防止しようとしているが、これは言い換えれば、表面エネルギーの小さい中間転写体を用い、虫喰い状の画像の発生を防止しているものといえる。

【0019】b. さらに、中間転写体を多層構成とし、離型性に優れた材料を最表層とすることで転写性向上、虫喰い状画像発生防止をはかるもの(特開昭62-293270号公報、特開平5-204255号公報、特開平5-204257号公報、特開平5-303293号公報)、及び、c. 中間転写体表面に離型性に優れた物質を供給し、転写性向上、虫喰い状画像発生防止をはかるもの(特開昭58-187968号公報)も前記

(4)の技術に分類できる。上記(4)の技術では、中間転写体の表面張力を低く抑え、トナーに対する離型性を向上させ、転写材に対する転写性を改善している。異種物質間の付着力は、表面張力の関数として表わされ、表面張力の増加に伴い、中間転写体に対するトナーの付着力が増大することは周知の事実である。ここで、純物質の場合、表面張力は表面エネルギーと同義である。また、一般的に純物質でなくとも、濡れ性と同時に表面張力は表面エネルギーの代用特性として扱われている。

【0020】上記(4)の技術において、トナーと像担持体、トナーと中間転写体、トナーと転写材の、各付着力は、各材料の静電気力、ファン・デル・ワールス力等、作用する全ての物理的な力を総合した力である。そして前記説明から理解されるように、中間転写体における表面エネルギーの低減化は、二次転写においては好都合であるが、一次転写においては必ずしも常に有利に作用するとは限らない。

【0021】(5) 中間転写体表面のトナー-フィルムミニングの除去に関する技術

中間転写体表面をフィルムミニング研削などによりリフレッシュして、転写性を維持し、経時による虫喰い状画像発生を防止をはかるもの(特開平5-273893号公報、特開平5-307344号公報、特開平5-313526号公報、特開平5-323802号公報等)が挙げられる。

【0022】前記した(1)～(4)の技術のうち、仮りに、(4)の技術課題が達成されて中間転写体の表面張力が理想どおりに低減されたたとすると、中間転写体のフィルムミニングは発生しなくなり、(5)の技術は不要となる。つまり、(5)の技術は例えば(4)の技術を用いた補完技術であるといえる。

【0023】一方、二次転写工程における虫喰い画像は、二次転写の手段として、ローラを媒介とするローラ転写を行う場合に発生しやすい。それは、次のa、bの2つの理由による。

a. フルカラー画像の場合、トナー層厚が厚くなることに加え、ローラによる機械圧力により、中間転写体の表面とトナー間の摩擦・ローラ力である機械的な付着力が強力に発生すること、つまり、ローラの圧接によるローラ圧の増大により中間転写体への機械的付着力が増大し、トナーの実効強度が増大し、トナー近接によりファン・デル・ワールス力が増大し、その結果、中間転写体へのトナー間付着力が増大する。

【0024】b. 画像形成プロセスを繰り返して実行する過程において、中間転写体表面にトナーがフィルム状に付着するトナーのフィルムミニング現象を起こす。つまり、一体表面とトナーとの間に付着力が発生する。つまり、一般的に、中間転写体にはトナーフィルムミニングが発生しないように表面張力又は表面エネルギーの小さい材料が選択使用されるが、その場合においても、(i)「中間転写体とトナーとの間に付着力が見合う付着力」は発生してしまう。そして、ひとたび、トナーフィルムミニングが発生すると、「中間転写体とトナー」との間の付着力は、(ii)「トナー同士の間表面張力で決定される付着力」となる。したがって、(i)の付着力よりも(ii)の付着力の方が大きいことは明白である。以上により、トナー間付着力が増大することから、転写が部分的になされない虫喰い現象が発生し、虫喰い画像を生ずるといえる。

【0025】二次転写工程における虫喰い画像の発生に際し、かかる虫喰い現象を回避する手段として、米国特許第5,053,827号明細書(METHOD AND APPARATUS FOR INTERMITTENT CONDITIONING OF A TRANSFER BELT)に開示された技術がある。

【0026】この米国特許には、中間転写体としての中間転写ベルトの表面エネルギーよりも小さい表面エネルギーを有するフッ素系の材料からなる部材で構成されているローラ(conditioning man)を中間転写ベルト表面に当て、中間転写ベルト表面の表面エネルギーを減じ、コンディショニングプロセスを有する、との開示がある。

【0027】さらに、ポリカーボネートを用いた中間転写ベルトを具体例として、その初期の表面エネルギーは37~38 dyn-cmであり、コンディショニングプロセスを用いないと40~45 dyn-cmに上昇し、40 dyn-cmを超えると転写の不具合が発生すると

微粉末が沈み始め、完全に沈んだ時の滴下メタノールのm lを計み、  
脱水化度＝ $\frac{\text{滴下メタノールのm l数}}{\text{（50+滴下メタノールのm l数）}} \times 100$ （％）

(6)

は、中間転写体上に異なる色のトナーが重なった後、転写材上に一度に転写（二次転写）する工程を経るが、像担持体から中間転写体上へは各色トナーが順次転写（一次転写）される。この場合、最初に一次転写されたトナーは中間転写体上でチャージ問題を多く受けるため帯電量が上昇しやすい。二次転写時のトナーの転写特性が一次転写の順により異なり、カラー画像の色調がオリジナル原稿と異なってしまうという不具合が生じる。このような不具合は本発明により解消される。以下、本発明を詳細に説明する。

【0038】本発明者が検討した結果、用いる現象利用の帯電量は現象側に高くすることにより、複色の二次転写時の転写特性が色によって一定化し、安定した色調のカラー画像が得られることが明らかとなった。また、現象利用の帯電量の絶対値は $10 \sim 30 \mu\text{C/g}$ とすることが転写特性を安定して得るために好ましい。

【0039】さらに、本発明に用いるトナーには、本発明の目的を達成するため、適切な流動性を付与する必要があり、凝集度は $5 \sim 25\%$ であることが好ましい。凝集度は $5\%$ 未満の場合には、転写時のトナーのチリが発生する場合があります。25%より大の場合には、転写時に虫喰いが発生する場合があります。

【0040】トナーの凝集度の測定は、次のような方法により行うことができる。すなわち、パウダーテスト（ボウカワミクロン社製）の用い、目盛り $7.5 \mu\text{m}$ 、 $4.5 \mu\text{m}$ 及び $2.2 \mu\text{m}$ の篩をこの順に上から振過し、目盛り $7.5 \mu\text{m}$ の篩に $2 \text{ g}$ のトナーを投入して、振過 $1 \text{ mm}$ で $30$ 秒振動を与え、振過後各篩上のトナー重量を測定、それぞれに $0.5$ 、 $0.3$ 及び $0.1$ の重みをかけ、加算して百分率で算出する。

【0041】また、特にトナーに混合する添加剤として、疎水性のシリカが本発明の目的を達成するため効果的である。ここで疎水性のシリカとは通常脱水化度 $50\%$ 以上のものを示す。シリカ微粉末の脱水化度は、シリカ微粉末の表面でシラン系化合物で表面処理（脱水化処理）することによってコントロールできる。即ち、シリカ微粉末に結合している水酸基にシラン化合物を反応させ、水酸基をシロキシル基等に置換することによりコントロールできる。したがって、脱水化度とは脱水化前に存在した水酸基のうちの上記反応により消失した水酸基の割合である。脱水化処理はシリカ微粉末にジアルキルハロゲン化シラン、トリアルキルハロゲン化シラン、ヘキサアルキルジシラン、アルキルトリハロゲン化シラン等を高温下で反応させることにより行なわれる。

【0042】また、前記シリカが微粉末の脱水化度は、次の方法により測定することができる。即ち、 $200 \text{ ml}$ のビーカーに水 $50 \text{ ml}$ を入れ、更に $0.2 \text{ g}$ のシリカ微粉末を添加する。そして、マグネットスターラーでゆるやかに攪拌しつつ、滴下時に先端が水中に浸漬されたビュレットからメタノールを加え、浮かんでいるシリカ

らかである。

【0034】また、用いられるトナーについて注目するに、虫喰い画像を防止するために、トナーの流動性を向上させて転写時の移動性をアップさせる方法や、トナーに樹脂粒子等を添加して転写時の押圧によるトナー同士との摩擦を防止する方法が知られている。しかしながら、トナーの流動性を向上しすぎた場合には、転写時にトナーが畚る現象が発生しやすくなり、文字等の忠実な再現ができなくなることがある。

【0035】

【発明が解決しようとする課題】したがって、本発明の目的は、上記従来技術における問題点を解消し、中間転写方式を用いた画像形成方法において、転写時に発生する局所的な転写不良（虫喰い）や、トナーのチリによる画像の再現性不良を防止することにある。

【0036】

【課題を解決するための手段】上記の課題は、本発明の（1）「像担持体上のトナー像を無機状の中間転写体上に一次転写する工程を複数回繰り返して重ねた転写像を形成し、この中間転写体上の重ねた転写像を一括して転写材上に二次転写するようにした中間転写方式を用いた画像形成方法において、少なくとも、ブラック、シア、マゼンタ、イエロー色からなるトナーを、像担持体上に順次現象化する際に、用いる現象利用の帯電量を高く保持し、かつ用いられる現象利用の帯電量の絶対値を $10 \sim 30 \mu\text{C/g}$ とすることを特徴とする画像形成方法、

（2）「前記用いられるトナーが、少なくとも疎水性シリカを含有し、凝集度が $5 \sim 25\%$ であることを特徴とする前記（1）項記載の画像形成方法」及び（3）「前記用いられる各々のトナーの着色度が $2 \sim 2.8$ であり、かつ該トナーの体積平均粒径が $4 \sim 9 \mu\text{m}$ であることと特徴とする前記（1）項記載の中間転写方式を用いた画像形成方法」によって解決され、また（4）「像担持体上のトナー像を無機状の中間転写体上に一次転写する工程を複数回繰り返して重ねた転写像を一括して、この中間転写体上の重ねた転写像を一括して転写材上に二次転写するようにした中間転写方式を用いた画像形成装置において、少なくとも、ブラック、シア、マゼンタ、イエロー色からなるトナーを、像担持体上に順次現象する際に、用いる現象利用の帯電量を高く保持し、かつ用いられる現象利用の帯電量の絶対値を $10 \sim 30 \mu\text{C/g}$ とすることを特徴とする画像形成装置」、（5）「前記用いられるトナーが、少なくとも疎水性シリカを含有し、凝集度が $5 \sim 25\%$ であることを特徴とする前記（4）項記載の画像形成装置」及び（6）「前記用いられる各々のトナーの体積平均粒径が $4 \sim 9 \mu\text{m}$ であることを特徴とする前記（4）項記載の中間転写方式を用いた画像形成装置」により解決される。

【0037】本発明が対象とする画像形成方法において

(5)

しており、この不具合を回避するために、上記したように、例えば、 $30 \text{ dyne-cm}$ 以下のフッ素をベースとした材料で形成されたローラをベルトに当て、表面にフッ素材料の薄いコート層を形成し、ベルト表面の表面エネルギーが上層を抑制することが述べられている。さらに、この光阻材料は、ベルト表面エネルギーを下げずに、逆に感光体が中間転写ベルトへの転写に不具合が発生する旨の提示がある。

【0028】我々は、後述する図1に示す中間転写ベルト（19）を用いた画像形成装置において、ポリカーボネートと材料とした中間転写ベルトを用いたところ、経時に二次転写において、虫喰い状の画像が発生した。【0029】中間転写ベルトに潤滑剤として、ステアリン酸亜鉛を塗布した実験を行ったところ、二次転写の不具合は解消されたが、トナーの付着量が減少し、"かすれ"状の画像が発生し、その発生場所を確認したところ、一次転写工程にて起こっていることが判明した。【0030】フッ素系の材料であるETFE（エチレン-テトラフルオロエチレン重合体）を用いた中間転写ベルトでは、初期から上記"かすれ"現象が生じた。これを従来例と比較してみると、中間転写ベルトの表面エネルギーが順次インジエニッシュングプロセスにより、NOxなど、コナチヤの放電生成ガスにより汚染されて徐々に表面エネルギーが上昇し、トナーは感光体側へ機械的に付着し易くなり、転写性が損なわれることによるものと考えられる。

【0031】かかる転写性能の劣化は、トナー像の一部が転写されない不具合の他に、ブラック、シア、マゼンタ、イエローの順に中間転写体へ像を重ねる作業順序を有する装置において、黒文字部などブラックトナー単色で再現される像部として転写されたブラックトナー像が以降の工程にて、感光体へ逆に転写されてしまう不具合としても顕在化する。ちなみに、ETFEの中間転写ベルトにて初期から不具合が発生したのは、初期段階にて感光体表面と中間転写ベルト表面の表面エネルギー差が大きく異なっているためであると考えられる。

【0032】これらの不具合を回避するために、前記米国特許に開示した技術では、中間転写ベルトの表面エネルギーが高くなりすぎたときに、コンディショニングプロセスを動作させることになっている。具体的には、予め決められたコピー枚数を超えた時点で、コンディショニングプロセスを動作させる。

【0033】しかしながら、複写作業を中断させコンディショニングプロセスを動作させる不都合は明らかであり、また、中間転写ベルト表面は、常に予め決められたコピー枚数後には一定の劣化になる訳でもないことは明

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特開平10-207164

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17.	ブラククトナー	シアフトナー	マゼンタナー	イエローター
結着樹脂	ポリエスチル樹脂：軟化点110℃		100重量部	
帯電抑制剤	サリチル酸誘導体亜塩基			
着色剤	(1.0重量部)	(1.0重量部)	(1.0重量部)	(1.0重量部)
	カーボンブラック顔料フタロンアミン	キナクリドン系顔料アゾ系顔料		
	ブルー			
	(C.I. Pigment Blue 15)	(C.I. Pigment Red 122)	(C.I. Pigment Yellow 130)	
	(7.2重量部)	(2.0重量部)	(3.8重量部)	(4.5重量部)
外添加工剤	疎水性シリカ（疎水化度70％）			
	(0.7重量部)	(0.7重量部)	(0.7重量部)	(0.7重量部)

を、実施例1と同様の条件でトナーを作成し、同一のキヤリアと所定量混合して現像剤とした。得られたトナー及び現像剤を用いて、実施例1と同様の評価を行なった。なお、得られたトナー及び現像剤の特性、更に、画質品質の評価結果を表7に記載する。

	[0066]	実施例3
	20	[0067]

着色剤	ブラクトナー	シアナー	マゼンタ	イエローターナー
導電性導液	ポリオール樹脂：軟化点110℃	100重量部		
着色剤	含フッ素炭素アンモニウム塩化合物 (1.0重量部)	(1.0重量部)	サリチル酸環状水添樹脂 (1.0重量部)	(1.2重量部)
	カーボンブラック顔料 ブルー	顔料 (C.I. Pigment Blue 15)	キナクリドン系顔料 Red 122)	(C.I. Pigment Yellow 130)
	(9.0重量部)	(3.5重量部)	(6.0重量部)	(6.0重量部)
外液薬剤	疎水性シリカ (疎水化度80%)			
	(0.5重量部)	(0.6重量部)	(0.7重量部)	(0.7重量部)

を、実施例1と同様の条件でトナーを作成し、同一のキヤリアと所定量混合して現像剤とした。得られたトナー及び現像剤を用いて、実施例1と同様の評価を行なった。なお、得られたトナー及び現像剤の特性、更に画質品質の評価結果を表7に記載する。

	40	[0068]	実施例4
		[0069]	
		[表4]	

21.	ブラックトナー	シアントトナー	マゼンタトナー	イエロートナー
結着樹脂	ポリエステル樹脂：軟化点105℃			
帯電制御剤	含フッ素第四級アンモニウム塩化合物			
着色剤	(1.0重量部) カーボンブラック ブルー	(1.0重量部) シアント ブルー	(1.0重量部) キナクリドン系顔料	(1.0重量部) アノ系顔料
外添加剤	(1.2重量部)	(5.0重量部)	(9.0重量部)	(9.0重量部)
	疎水性シリカ（疎水化度30%）			
	(0.8重量部)	(0.8重量部)	(0.8重量部)	(0.8重量部)

19	ブラックトナー	シアントトナー	マゼンタトナー	イエロートナー
結着樹脂	ポリエステル樹脂：軟化点98℃			
帯電制御剤	含フッ素第四級アンモニウム塩／シリチル酸誘導体亜塩塩			
着色剤	(1.0/0.5重量部)	(0.8/0.7重量部)	(0.6/0.8重量部)	(0.4/0.9重量部)
	カーボンブラック	銅フタロシアニンブルー	キナクリドン系染料	アゾ系染料
	(9.0重量部)	(C.I.Pigment Blue 15)	(C.I.Pigment Red 122)	(C.I.Pigment Yellow 130)
外添加剤	(9.0重量部)			
	疎水性シリカ (疎水化度80%)			
	(0.6重量部)			
	(0.7重量部)			

を、実施例1と同様の条件でトナーを作成し、同一のキヤリアと所定量混合して現像剤とした。得られたトナー及び現像剤を用いて、実施例1と同様の評価を行なった。なお、得られたトナー及び現像剤の特性、更に、画質の評価結果を表7に記載する。

を、実施例1と同様の条件でトナーを作成し、同一のキヤリアと所定量混合して現像剤とした。得られたトナー及び現像剤を用いて、実施例1と同様の評価を行なった。なお、得られたトナー及び現像剤の特性、更に、画質の評価結果を表7に記載する。

	ブラックトナー	シアントトナー	マゼンタトナー	イエロートナー
結着樹脂	ポリオール樹脂：軟化点105℃			
帯電制御剤	含フッ素第四級アンモニウム塩化合物			
着色剤	(1.2重量部)	(0.8重量部)	(0.8重量部)	(0.8重量部)
	カーボンブラック顔料 ブルー	カーボンブラック顔料 シアニン	キナクリドン系顔料 アン系顔料	
外添加剤	(9.0重量部)	(3.5重量部)	(6.0重量部)	(6.2重量部)
	疎水性酸化チタン（疎水化度20％）			
	(0.7重量部)	(0.7重量部)	(0.7重量部)	(0.7重量部)

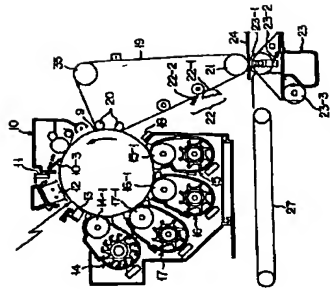
を、実施例1と同様の条件でトナーを作成し、同一のキヤリアと所定量混合して現像剤とした。得られたトナー及び現像剤を用いて、実施例1と同様の評価を行なった。なお、得られたトナー及び現像剤の特性、更に、画質の評価結果を表7に記載する。

を、実施例1と同様の条件でトナーを作成し、同一のキヤリアと所定量混合して現像剤とした。得られたトナー及び現像剤を用いて、実施例1と同様の評価を行なった。なお、得られたトナー及び現像剤の特性、更に、画質の評価結果を表7に記載する。





【図4】



フロントページの続き

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